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BOOK REVIEW

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Ecology and conservation of the Dutch ground beetle fauna – Lessons from 66 years of pitfall trapping

Authors: Hans Turin, D. Johan Kotze, Stefan Müller-Kroehling, Pavel Saska, John Spence and Theodoor Heijerman. Wageningen Academic Publishers, The Netherlands, 2022 – 452 pages – full-colour – hardback – ISBN: 978-90-8686-369-3 – EUR 99 excl. VAT

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It would be difficult for Carabidologists to overlook the impressive discoveries of their Dutch colleagues, who have been shaping the ecological research mindset in Europe for more than half a century. The authors of this book included all the relevant data collected by the amateur and professional entomologists who have been meticulously researching carabid ecology and functions in ecosystems for the purposes of conservation and restoration for 66 years across The Netherlands. The result is an impressive database, based on nearly 6000 samples, most of which is being analysed and published here for the first time. In this book, the Dutch Carabidologists Hans Turin and Theodoor Heijerman are joined by the Carabidologists Johan Kotze, Stefan Müller-Kroehling, Pavel Saska and John Spence, who analysed the Dutch database in terms of urban and forest ecology, conservation biology, trend analyses and other topics and were included in writing certain chapters and revising the whole manuscript.

If the authors had aimed to create a compendium of overall knowledge on carabids, they would have had to surpass the impressive foundational work of Lindroth (1945, 1949) and the compilation of information on carabid biology and ecology by

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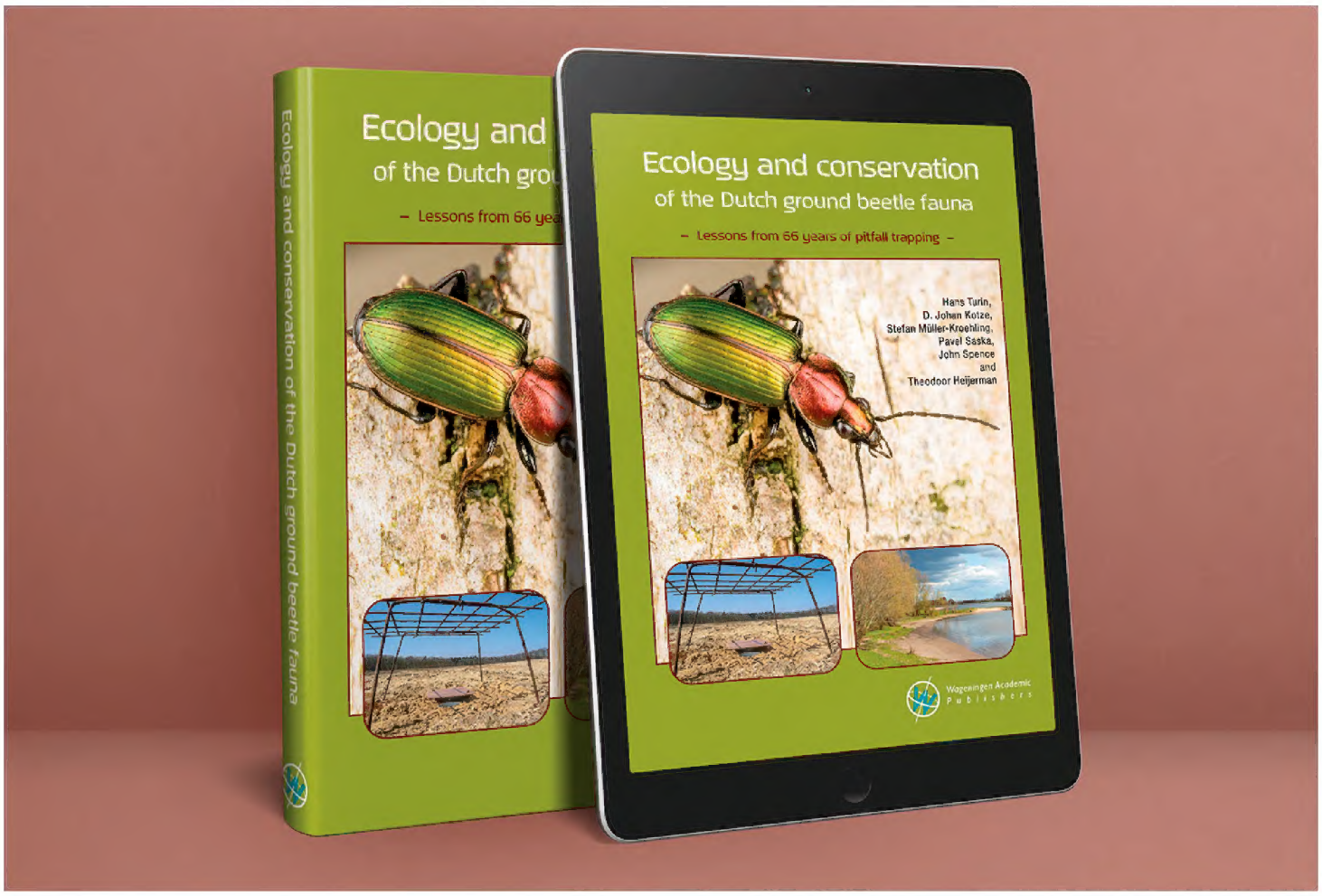

Thiele (1977). However, the authors did not aim to create a comprehensive encyclopaedia, but instead to link the wealth of data collected across The Netherlands to current ecological issues and reveal trends that can be observed only after many years of continuous research.

I am confident that most biologists, especially Carabidologists, will feel the same "wow" excitement I felt when I received the book, similar to how I felt when I purchased "The Genus Carabus of Europe" (Turin et al. 2003) after receiving my first pay cheque. The more recent work of Turin and colleagues has an opulent, large-format appearance with more than 400 pages full of high-quality, full-colour photographs of beautiful carabid beetles. The appearance alone speaks about how much Wageningen Academic Publishers supported the authors and their content. The price is quite reasonable given the value of the work.

The book has eight chapters, organised in a logical and coherent order. They begin with a short, clearly written, straightforward introduction (Chapter 1), followed by general information about the Dutch database as well as carabid biology and ecology (Chapter 2) and quite useful tips on pitfall trapping, based on the authors' long experience (Chapter 3). Chapters 4 and 5 are the core of the book, presenting the habitat reference method and providing data on traits, biogeography, species habitat affinity groupings and updates on ground beetle fauna of The Netherlands. Trend analyses of the pitfall trap database and the importance of trend studies are presented in Chapter 6, while Chapter 7 describes the use of carabids as indicators species in conservation studies. Chapter 8 concludes with a synthesis of insights from the Dutch database.

The book contains many interesting insights, such as the comparison of carabid beetles across central and northwest Europe in terms of their reproductive activity, accompanied by striking photographs (Chapter 2). For instance, the authors describe similarities and differences in *Leistus rufomarginatus* phenology across several central European countries and they neatly illustrate variation in reproductive activity for the 68 most abundant species in the Drenthe research area. Field ecologists and entomologists will likely appreciate their classification of the developmental types of carabids (Chapter 2), based on the work of Den Boer and Van Dijk (1996, 1998), given the difficulty of analysing these traits *in situ*. Nevertheless, such analysis is essential to ecological studies. The same applies for the section about the dispersal power of carabids and their linkages to environmental stability. The authors discuss not only important research studies on dispersal power, but also internal work by Van Huizen about wing development and flight time that Piet den Boer observed and collected in the Province of Drenthe. The section comparing carabids collected with pitfall traps or window traps is also interesting, as is the section about the temperature organ, which can inspire future ecological research. These sections are supported with very effective charts and illustrations.

The efficiency of pitfall trapping has made carabids an integral part of a wide variety of biological and ecological studies. Around the world, carabidologists and other biologists have used pitfall traps to study ground-dwelling invertebrates and the method has been applied in The Netherlands since the 1950s. Chapter 3 describes the distribution of the samples collected using pitfall traps across 12 Dutch provinces and analysed in the book and their use in short- and long-term studies is discussed in detail. Pitfall trapping is time-consuming, so field biologists will definitely appreciate the insights provided by authors, based on the impressive dataset, which can help design studies that make the most out of the method. I strongly recommend that entomologists, whether young or experienced, read Chapter 3 in order to avoid wasted effort. More than six decades of continuous sampling using pitfall trapping, while also maintaining the Dutch database, have led to fascinating insights on carabids and development of a habitat reference method and analyses of trends in light of biodiversity changes which make this book highly relevant. As we witness a strong decline in overall biodiversity, which some sources describe in apocalyptic terms, it is important to have valid datasets that document relevant trends. In Chapter 6, the authors analyse whether pitfall catches can reveal long-term, nationwide trends, as well as whether habitat characteristic species change more over time than non-characteristic species, which may help clarify threats to Dutch habitats and ground beetles.

The authors use the newly-developed habitat reference method to classify not only carabid species, but also habitats in ecological terms. By analysing pitfall trapping at 862 sites across The Netherlands, Turin and colleagues developed the new classification applied to all-year samples from the 1953 to 2018. The samples used in previously developed ecological classification (HAB1) (Turin et al. 1991) have been re-classified according to the 17 new habitat groups (HAB2) as discussed in Chapter 5. They describe complex relationships between habitats and species using excellent, straightfor-

ward explanations, together with informative charts and tables. Habitat charts provide quick insights into which carabid species are present at a given location, illustrating the application of habitat referencing. This method may be applicable to monitoring projects and studies comparing new data with previously sampled data. The authors also use the habitat reference method to identify characteristic species and co-occurring species in Dutch habitats.

The entire book, especially the pages describing carabid fauna in The Netherlands in Chapters 4 and 5, abounds with fabulous photographs by Theodoor Heijerman. These images present the full splendour of carabids and the Dutch landscape, including some peculiar habitats. I see this book as an indispensable resource in the conservation of insects and habitats. The decline in diversity and abundance of animals as evolutionarily successful as insects requires the raising of global awareness and the implementation of evidence-based measures. Analysing such a meticulously collected and edited database, the authors of this book construct firm foundations for conservation insights and strategies, which reflect their research curiosity and genuine passion for nature conservation.

Dutch entomologists and carabidologists have played an important role in research on carabid conservation. Their conservation efforts have focused on protecting particular species, such as *Carabus nitens*, a medium-sized, shiny carabid sensitive to habitat loss; and on using carabids as indicator species to protect various habitats. Their abundance and species diversity make carabid beetles useful for distinguishing natural and anthropogenic disturbances. They have proven useful for assessing how climate change, land use, pesticide use and environmental pollution affect faunal composition. Nowadays, as we face climate change, it is more important than ever to explore what the world of insects can tell us about our world and how it is changing. Numerous inspiring breakthroughs have been published that establish carabids and their habitats as indicators of changes that affect us. Chapter 7 clearly describes the use of carabids as indicators, such as in conservation studies. By using carabids in habitat restoration processes, Dutch entomologists have provided valuable contributions to the restoration of wetlands, peatlands and heats on inland dunes in drift-sand areas. The authors provide a coherent overview of research insights that may help develop insect conservation action plans for this century.

Therefore, I strongly recommend the book to students and scholars of ecology, species-habitat relationships and nature conservation, as well as to experienced ecologists who crave new insights and specialists, such as carabidologists, who will undoubtedly enjoy reading it.